

AMENDMENTS TO THE CLAIMS

Kindly amend claim 20 as shown in the listing of claims below. This listing of claims will replace all prior versions, and listings of claims in the application.

LISTING OF CLAIMS

- 1 Claim 1. (original) A method for reducing stiction in a MEMS device having a moveable
2 element moveably coupled to a substrate, the method comprising:
3 a) providing the substrate with an anti-stiction member; and
4 b) interposing the anti-stiction member between the moveable element and the
5 substrate.
- 1 Claim 2. (original) The method of claim 1 wherein step b) includes actuating the
2 moveable element to interpose the anti-stiction member between the moveable
3 element and the substrate.
- 1 Claim 3. (original) The method of claim 2 wherein step b) includes substantially
2 immersing the moveable element in a liquid during actuation of the moveable
3 element.
- 1 Claim 4. (original) The method of claim 1, wherein step a) includes providing an anti-
2 stiction member that overhangs the moveable element.
- 1 Claim 5. (original) The method of claim 4, wherein the anti-stiction member includes one
2 or more flexible portions.
- 1 Claim 6. (original) The method of claim 5, wherein the one or more flexible portions
2 includes at least one double-serpentine portion.
- 1 Claim 7. (original) The method of claim 4 wherein the anti-stiction member is made of a
2 flexible material.

1 Claim 8. (original) The method of claim 4 wherein step b) includes actuating the
2 moveable element whereby the moveable element engages the anti-stiction
3 member causing the anti-stiction member to flex.

1 Claim 9. (original) The method of claim 8 wherein step b) includes flexing the anti-
2 stiction member sufficiently to interpose the anti-stiction member between the
3 moveable element and the substrate.

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1 Claim 10. (original) The method of claim 1 wherein step a) includes:
2 providing a silicon-on-insulator (SOI) substrate;
3 defining the moveable element from a device layer of the SOI substrate; and
4 depositing a flexible material over the device layer and the moveable element
5 such that the flexible material overhangs the moveable element.

1 Claim 11. (original) The method of claim 1 further comprising: minimizing an area of
2 contact between the anti-stiction member and the moveable element.

1 Claim 12. (original) The method of claim 1 further comprising electrically isolating the
2 moveable element from a portion of the substrate.

1 Claim 13. (original) The method of claim 12 wherein the isolating step includes
2 interposing an insulating material between the anti-stiction member and an
3 electrically conductive portion of the moveable element.


1 Claim 14. (original) The method of claim 12 wherein the isolating step includes
2 interposing an insulating material between the anti-stiction member and the
3 portion of the substrate.

1 Claim 15. (original) An apparatus for reducing stiction in a MEMS device having a moveable
2 element moveably coupled to a substrate, the apparatus comprising:
3 an anti-stiction member that is interposable between the moveable element and the
4 substrate.

1 Claim 16. (original) The apparatus of claim 15 wherein the anti-stiction member is
2 attached to the substrate.

1 Claim 17. (original) The apparatus of claim 16 wherein the anti-stiction member is not
2 attached to the moveable element.

1 Claim 18. (original) The apparatus of claim 15 wherein the anti-stiction member is
2 cantilevered such that the anti-stiction member overhangs the moveable element.

 Claim 19. (original) The apparatus of claim 15 wherein the anti-stiction member is made
from a flexible material.

1 Claim 20. (currently amended) The apparatus of claim 15 wherein the anti-stiction
2 member includes one or more flexible portions disposed between a fixed end and
3 a free end of the anti-stiction member.

1 Claim 21. (original) The apparatus of claim 20 wherein the one or more flexible portions
2 include at least one serpentine portion.

1 Claim 22. (original) The apparatus of claim 20 wherein the one or more flexible portions
2 include at least one double serpentine portion.

1 Claim 23. (original) The apparatus of claim 15 further comprising a standoff attached to a
2 free end of the anti-stiction member.


1 Claim 24. (original) The apparatus of claim 15, further comprising means for electrically
2 isolating the moveable element from a portion of the substrate.

1 Claim 25. (original) The apparatus of claim 24, wherein the means for electrically
2 isolating includes an electrically insulating standoff attached to a free end of the
3 anti-stiction member.

1 Claim 26. (original) The apparatus of claim 24, wherein the means for electrically
2 isolating includes an electrically insulating portion of the moveable element.

1 Claim 27. (original) The apparatus of claim 15, wherein the anti-stiction member includes
2 a serpentine shaped portion that is disposed between a free end and a fixed end of
3 the anti-stiction member.

1 Claim 28. (original) The apparatus of claim 15, wherein the anti-stiction member includes
2 one or more double-serpentine shaped portions that are disposed between a free
3 end and a fixed end of the anti-stiction member.

 1 Claim 29. (original) A MEMS device, comprising:
2 a substrate;
3 a moveable element moveably coupled to the substrate, and
4 an anti-stiction member that is interposable between the moveable element and the
5 substrate.

1 Claim 30. (original) The MEMS device of claim 28 wherein the anti-stiction member is
2 attached to the substrate.

1 Claim 31. (original) The MEMS device of claim 30 wherein the anti-stiction member is
2 not attached to the moveable element.

1 Claim 32. (original) The MEMS device of claim 28 wherein the anti-stiction member is
2 cantilevered such that the anti-stiction member overhangs the moveable element.

1 Claim 33. (original) The MEMS device of claim 29 wherein the anti-stiction member is
2 made from a flexible material.

1 Claim 34. (original) The MEMS device of claim 29 wherein the anti-stiction member
2 includes one or more flexible portions disposed between a fixed end and a free
3 end of the anti-stiction member.

1 Claim 35. (original) The MEMS device of claim 29, wherein the one or more flexible
2 portions include a serpentine portion.

1 Claim 36. (original) The MEMS device of claim 29, wherein the one or more flexible
2 portions include at least one double-serpentine portion.

1 Claim 37. (original) The MEMS device of claim 29 further comprising a standoff
2 attached to a free end of the anti-stiction member.

1 Claim 38. (original) The MEMS device of claim 29 further comprising means for
2 electrically isolating the moveable element from a portion of the substrate.

1 Claim 39. (original) The MEMS device of claim 38, wherein the means for electrically
2 isolating includes an electrically insulating standoff attached to a free end of the
3 anti-stiction member.

1 Claim 40. (original) The MEMS device of claim 39, wherein the means for electrically
2 isolating includes an electrically insulating portion of the moveable element.

1 Claim 41. (original) The MEMS device of claim 29 wherein the moveable element
2 includes a light-deflecting component.

1 Claim 42. (original) The MEMS device of claim 41, wherein the light-deflecting
2 component is plane reflecting (or partially reflecting) surface, curved reflecting
3 (or partially reflecting) surface, prismatic reflector, refractive element, prism,
4 lens, diffractive element, grating, fresnel lens, dichroic coated surface, waveguide
5 or some combination of these.


1 Claim 43. (original) The MEMS device of claim 41 wherein the light-deflecting
2 component is a mirror.

1 Claim 44. (original) The MEMS device of claim 29, wherein the moveable element is
2 configured to rotate.

1 Claim 45 (original) The MEMS device of claim 29, wherein the moveable element is
2 configured to translate.

1 Claim 46. (original) A method for fabricating a MEMS device, comprising:

2 providing a silicon-on-insulator (SOI) substrate;
3 defining a moveable element from a device layer of the SOI substrate; and
4 depositing a flexible material over the device layer and the moveable element such that
5 one or more portions of the flexible material overhang the moveable element,
6 wherein the flexible material is deposited such that the anti-stiction member is attached to
7 one end to a portion of the device layer,
8 wherein the flexible material is deposited such that the anti-stiction member is not
9 attached to the moveable element;

 whereby the flexible material forms one or more anti-stiction members.

Claim 47. (original) The method of claim 46 wherein an insulating material is deposited
2 between defining the moveable element and depositing the flexible material.

1 Claim 48. (original) The method of claim 47, further comprising etching the insulating
2 material to release the moveable element.

1 Claim 49. (original) The method of claim 48, wherein the flexible material is resistant to
2 an etchant that is used to remove the insulating material.

1 Claim 50. (original) An optical switch, comprising:

2 a substrate;
3 one or more moveable elements moveably coupled to the substrate, and
4 an anti-stiction member that is interposable between at least one of the moveable
5 elements and the substrate.

1 Claim 51. (original) The optical switch of claim 50 wherein at least one of the moveable
2 elements includes a light-deflecting component.

1 Claim 52. (original) The optical switch of claim 51 wherein the light-deflecting
2 component is a plane reflecting (or partially reflecting) surface, curved reflecting
3 (or partially reflecting) surface, prismatic reflector, refractive element, prism,
4 lens, diffractive element, grating, fresnel lens, dichroic coated surface, waveguide
5 or some combination of these.

1 Claim 53. (original) The optical switch of claim 51 wherein the light-deflecting
2 component is a mirror.

1 Claim 54. (original) The optical switch of claim 50 wherein the anti-stiction member is
2 attached to the substrate.

1 Claim 55. (original) The optical switch of claim 54 wherein the anti-stiction member is
2 not attached to the moveable element.

1 Claim 56. (original) The optical switch of claim 50 wherein the anti-stiction member is
2 cantilevered such that the anti-stiction member overhangs the moveable element.

1 Claim 57. (original) The optical switch of claim 50 wherein the anti-stiction member is
2 made from a flexible material.

1 Claim 58. (original) The optical switch of claim 50 wherein the anti-stiction member
2 includes one or more flexible portions disposed between a fixed end and a free
3 end of the anti-stiction member.

1 Claim 59. (original) The optical switch of claim 58, wherein the flexible portion includes
2 a serpentine portion.

1 Claim 60. (original) The optical switch of claim 58, wherein the flexible portion includes
2 at least one double serpentine portion.
